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Temperature and doping dependences of spin susceptibility $La_{2-x}Sr_xCuO_4$

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Using the two relevant bands model, the temperature and doping dependences of the spin susceptibility $La_{2-x}Sr_xCuO_4$ at $T > T_c$ have been calculated. The effect of strong correlations has been taken into account. We have found that model explains many features of the experimental data.

Recently, a new two relevant bands model has been suggested for layered cuprates [1,2]. This model describes the quasipartical states near the bottom of the singlet oxygen band more accurate than it is provided by the *t-J* model. There is a peak in the density of states near the bottom of the singlet band in the model [1,2]. As it was pointed out before in [1] that fact is very important for $La_{2-x}Sr_xCuO_4$, because in these compounds at $0.1 < x < 0.25$ the holes occupied certainly the bottom of the singlet correlated oxygen band. Here we present a part of our calculations of spin susceptibility in a frame of that model [1,2].

The principal difference of our present calculations from earliers [3,4,5] is that we are taken into account the non-Fermi liquid behaviour of susceptibility. The temperature and doping dependences of spin susceptibility were calculated using the formula [6]

$$\chi(\delta,\theta)=\frac{(1+\delta)^2\,\chi_p(\delta,\theta)}{4\delta+\Lambda(\delta,\theta)-Z(\delta,\theta)} \tag{1}$$

where $\chi(\delta,\theta)$ is a typical expression for the Pauli - Lindhard susceptibility

$$\chi_p(\delta,\theta)=-\frac{1}{2N}(g\beta)^2\sum_k\left\{c_{1k}\frac{\partial f(\varepsilon_{1k})}{\partial\varepsilon_{1k}}+c_{2k}\frac{\partial f(\varepsilon_{2k})}{\partial\varepsilon_{2k}}\right\}. \tag{2}$$

$f(\varepsilon_k)$ is the Fermi function and

$$c_{1k}=\frac{\varepsilon_{1k}-E_k^{dd}}{\varepsilon_{1k}-\varepsilon_{2k}},\quad c_{2k}=\frac{E_k^{dd}-\varepsilon_{2k}}{\varepsilon_{1k}-\varepsilon_{2k}}. \tag{3}$$

The functions $Z(\delta,\theta)$ and $\Lambda(\delta,\theta)$ are given by

$$Z(\delta,\theta)=-\frac{(1+\delta)^2}{2N}\sum_k\left\{c_{1k}F_{1k}\frac{\partial f(\varepsilon_{1k})}{\partial\varepsilon_{1k}}+c_{2k}F_{2k}\frac{\partial f(\varepsilon_{2k})}{\partial\varepsilon_{2k}}\right\}, \tag{4}$$

$$\Lambda(\delta,\theta)=\frac{(1+\delta)^2}{2N}\sum_k\Phi_k\left[f(\varepsilon_{1k})-f(\varepsilon_{2k})\right]. \tag{5}$$

Entering here F_{1k}, F_{2k} and Φ_k are written by

$$F_{1k,2k}=t_k^p-t_k^d\pm\frac{1}{\varepsilon_{1k}-\varepsilon_{2k}}\left\{-2\delta t_k^{pd}t_k^{dp}+(E_k^{pp}-E_k^{dd})(t_k^p+t_k^d)\right\}, \tag{6}$$

$$\Phi_k=\frac{t_k^p+t_k^d}{\varepsilon_{1k}-\varepsilon_{2k}}+\frac{E_k^{pp}-E_k^{dd}}{(\varepsilon_{1k}-\varepsilon_{2k})^2}\left\{2\delta t_k^{pd}t_k^{dp}-(E_k^{pp}-E_k^{dd})(t_k^p+t_k^d)\right\}. \tag{7}$$

For the energy dispersions ε_{1k} and ε_{2k} instead of Hubbard I approximation, which was exploited in [6], now we are using more accurate variant as in [2]. They are determined by the expressions

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